REMARKS

Favorable reconsideration of this application is requested in view of the above amendments and the following remarks. Claims 1-3 are amended. Claims 1-15 are pending in the application. The changes made to the claims by the current amendment are attached hereto as a page entitled "Version with Markings to Show Changes Made."

Claims 1 and 2 were rejected under 35 U.S.C. § 102(b) as being anticipated by *Kasanami et al.* (U.S. Patent No. 5,349,857). Applicants traverse this rejection to the extent it is maintained.

Independent claim 1 has been amended to include some of the limitations of claims 2 and 3. Claim 1 requires a piezoelectric substrate having a shape of an elongated rectangular solid, first and second excited electrodes formed on a part of at least one principal plane of the piezoelectric element, and a thickness shear vibration that occurs in a direction that is non-parallel to a side wall in a longitudinal direction of the piezoelectric substrate. Applicants contend that the thickness shear vibration required for the piezoelectric element of claim 1 is not taught or suggested by *Kasanami* or the other cited references.

The term "thickness shear vibration" is a technical term having a particular meaning. The meaning of this term is described, for example, in "3 9 3 Shear Vibrator" on page 345 of "Ultrasonic Technique Guide (Newly Revised Edition)" (1978) by "The Nikkan Kogyo Shimbun Ltd." A copy of pages 345-347 of "Ultrasonic Technique Guide" is attached hereto as a separate page. The following is a translation of a portion of pages 345 and 346.

3・9・3 Shear Vibrator

A shear vibrator has two systems: a thickness shear and a face shear.

(1) Thickness shear vibrator

A thickness shear vibrator is a vibrator that raises a shear which is parallel to an electrode surface, as shown in Figure 3.84.

The "thickness shear vibrator" is also described in a footnote on page 184 of "Design of Resonant Piezoelectric Devices" written by Richard Holland and E. P. Eernisse (THE MIT PRESS, 1969). Regarding the "thickness shear vibration," there is the following description in the footnote: (i) particle displacement and propagation are in a plane of a plate; and (ii) particle displacement and propagation are parallel to each other. A copy of page 184 of "Design of Resonant Piezoelectric Devices" is attached hereto on a separate page.

As is apparent from the above definitions, the "thickness shear vibration" occurs as is shown in Figure A (attached on separate page). That is, the displacement direction and propagation direction are in parallel planes to a plane of the plate (the piezoelectric substrate of claim 1).

In contrast, *Kasanami* teaches a vibrator utilizing bending motion (column 6, line 8). This "bending motion" is also a technical term in the field of vibrators. This term is described, for example, in "3 9 5 Bending Vibrator" on page 347 of "Ultrasonic Technique Guide (Newly-Revised Edition)" (1978) by "The Nikkan Kogyo Shimbun Ltd." In the "Ultrasonic Technique Guide," a bimorph vibrator is described as a typical example of a bending vibrator. The following is a translation of the relevant portions of page 347.

> 3·9·5 Bending Vibrator
>
> (1) Bimorph Vibrator
>
> Bending vibration occurs when two piezoelectric plates that expand or contract in a length direction are attached to each other so that one of the plates contracts while the other expands (Figure 3.87). A vibrator thus obtained is called a bimorph vibrator, which is used for vibration in a range of tens of c/s to about 10 kc.

In the bimorph vibrator, piezoelectric plates are attached so as to be shifted from a neutral surface of the entire vibrator (see Figure 3.87 at page 347 of "Ultrasonic Technique Guide"). Therefore, when a piezoelectric plate is displaced so as to expand, the vibrator exhibits bending motion in a direction vertical to the displacement of the piezoelectric plate. Such bending

motion becomes vibration as shown in Figure B (attached on separate page). As shown in Figure B, the bending motion, particle displacement, and propagation are vertical to each other.

The vibrator taught by *Kasanami* is a vibrator obtained by modifying the bimorph vibrator, which causes bending motion. The vibrator of *Kasanami* is therefore clearly different from the piezoelectric element of claim 1 that causes thickness shear vibration.

Claim 1 also requires that a normal line of an edge in a longitudinal direction of the first and second exciting electrodes are parallel to each other and are non-parallel to the side wall in the longitudinal direction of the piezoelectric substrate.

Kasanami, as shown in Figures 20 and 21, teaches a normal line of an edge of the electrode that is parallel to the side wall. Furthermore, in the vibrator of *Kasanami*, thickness shear vibration is not disclosed or suggested. Applicants therefore request reconsideration of claims 1 and 2.

Claim 3 was rejected under 35 U.S.C. § 103(a) as being unpatentable over *Kasanami* in view of *Yanagihara et al.* (U.S. Patent No. 6,057,630). Claims 1 and 2 are allowable over *Kasanami* for the reasons stated above concerning § 102(b). *Yanagihara* does not remedy the deficiencies of *Kasanami*. Therefore, Applicants submit that claim 3 is allowable for at least the reason it is dependent upon an allowable base claim. Applicants do not concede the correctness of this rejection.

Claims 9 and 15 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Kasanami* in view of *Mandai et al.* (U.S. Patent No. 6,064,351). Applicants respectfully traverse this rejection. *Mandai* does not remedy the deficiencies of *Kasanami* as to independent 1. Therefore claims 9 and 15 are allowable for at least the reason they are dependent upon an allowable base claim. Applicants do not concede the correctness of this rejection.

Claims 4, 5, 10 and 11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Kasanami* in view of *Yanagihara, Mandai* and ordinary skill in the art. Applicants respectfully traverse this rejection.

Claims 4 and 10 define a direction of a side wall of a piezoelectric substrate. According to the configurations set forth in claims 4 and 10, a piezoelectric vibrator is easily produced, has even smaller spurious, and thus allows operation at high frequencies. Claims 5 and 11 define the relationship between a normal line of an edge of the electrode and a side wall. According to the configurations set forth in claims 5 and 11, a piezoelectric vibrator having an even smaller spurious is obtained. The limitations of claims 4, 5, 10 and 11 are not simply a matter of design, and are not disclosed in the combination of references cited by the Examiner. Applicants request reconsideration of claims 4, 5, 10 and 11. Furthermore, claims 4, 5, 10 and 11 are allowable for at least the reason they are dependent upon allowable base claim 1.

Claims 6-8 and 12-14 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Kasanami* in view of *Yanagihara* and *Mandai*, ordinary skill in the art and *Hermann* (U.S. Patent No. 4,126,802). Applicants respectfully traverse this rejection. *Yanagihara, Mandai*, ordinary skill in the art, and *Hermann* do not remedy the deficiencies of *Kasanami* set forth above, either alone or in combination. Reconsideration of claims 6-8 and 12-14 is respectfully requested. Applicants do not concede the correctness of this rejection.

As to the response to arguments in section 8 of the Action, Applicants direct the Examiner to the technical definitions of "thickness shear vibration" and "bending motion," as it relates a bimorph vibrator, described above. Applicants submit that these terms, as properly defined, distinguish the claimed invention from the references cited in the Action.

In view of the above, it is respectfully submitted that the present application is in condition for allowance. Reconsideration of the present application and a favorable response in the form of a notice of allowance is respectfully requested.

If a telephone conference would be helpful in resolving the issues concerning this communication, please contact Applicant's primary attorney of record, Douglas P. Mueller, at (612) 371-5237.

Dated: March 4, 2002

Respectfully submitted,

MERCHANT & GOULD P.C.
P.O. Box 2903
Minneapolis, MN 55402-0903
(612) 332-5300

By: _____
Douglas P. Mueller
Reg. No. 30,300
DPM:JNR:WP:cz:ae

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Claims

Claims 1-3 have been amended as follows:

1. (Amended) A piezoelectric element comprising:

a piezoelectric substrate having a shape of an elongated rectangular solid, and

[a pair of electrodes] first and second exciting electrodes formed on a part of at least one principal plane selected from the group consisting of a first principal plane of the piezoelectric substrate and a second principal plane opposed to the first principal plane,

wherein thickness shear vibration occurs, [and]

a vibration direction of the thickness shear vibration is nonparallel to a side wall in a longitudinal direction of the piezoelectric substrate, and

a normal line of an edge in the longitudinal direction of the first exciting electrode and a normal line of an edge in the longitudinal direction of the second exciting electrode are parallel to each other, and are nonparallel to the side wall in the longitudinal direction of the piezoelectric substrate.

2. (Amended) The piezoelectric element according to claim 1,

wherein [the piezoelectric substrate has a shape of an elongated rectangular solid, and

each of the pair of electrodes is] the first and second exciting electrodes are formed along an entire width in a traverse direction of the substrate on said at least one principal plane.

3. (Amended) The piezoelectric element according to claim 2,

wherein the piezoelectric substrate is formed of $LiTaO_3$ single crystal,

[the pair of electrodes includes a first exciting electrode and a second exciting electrode,]

the first exciting electrode is formed on the first principal plane, and

the second exciting electrode is formed on the second principal plane[,

the side wall is a side wall in a longitudinal direction of the piezoelectric substrate, and

a normal line of an edge of the first exciting electrode and a normal line of an edge of the second exciting electrode are parallel to each other and are nonparallel to the side wall in the longitudinal direction].